of natural selection, when once fairly engaged in the struggle for existence, no less a penalty than ultimate extinction awaits the weaker race. If the parallelism between a race and a sex can be maintained at all—and the parallelism is Mr. Huxley's, not ours—it plainly implies that, put into competition with man, woman must sooner or later cease to exist *as a competitor*, just as certainly as the black rat has been driven out before the *Mus decumanus*, or as, to adopt a different class of example, the handloom weavers have been driven from the market by machinery and steam. But while we thus doubt the wisdom, or indeed the possibility, of placing women on a level with men, and in competition with them, we would by no means therefore be understood to argue against giving them a liberal education or improving the law in regard to their property.

Passing on to consider for a short time the Educational essays, we need say but a very few words of the single specimen given of the writer's method in practical education, viz. the Lecture on a Piece of Chalk. It is certain to be well known to most of our readers. Those who do know it, for the most part recognise it as a model both in matter and in manner of what a single lecture ought to be; those who do not had better read it at once, for till they have so done they will have but an imperfect idea of such a model. The other educational essays, viz. the first six in the book (with the exception of the second) contain an exposition of the author's views on many of those points in the theory of education which are most keenly disputed at the present time, such as the value of natural science as contrasted with mathematics or philology as an instrument of education; that of the natural history sciences as contrasted with other branches of natural science, the method by which they should be taught, &c. Now it is only fair to admit that in all these matters Professor Huxley's addresses must be looked upon as the speeches of an advocate, and moreover of an advocate who feels that he carries the feeling of the public with him for the most part, but is by no means equally sure that he can overcome the prejudices of the jury. Still, considered as the speeches of an advocate, they are admirable, and it must be remembered that an advocate may prove his case, and this, we think, Mr. Huxley has in several instances done. In regard to the most important of the questions discussed, we are disposed to believe that any one of these three instruments of education may turn out a highly cultivated and thoroughly well educated man, provided the teacher knows how to teach and the learner presents good raw material upon which he may exercise his skill; but this by no means proves that they are all of equal value. One thing we can certainly say in regard to the classical education of our own day, that is to say, of the day of those who are the acting men of the present generation, viz., that, however well it may have served the turn of that small minority who were sure to make the best of any kind of education, and for whom, therefore, it is the least necessary to make provision, it has done nothing at all for the great majority of those who have been submitted to it. It is not too much to say, that out of the men who have gone from public schools to Oxford, and who have spent their whole lives between the ages of eight and twenty-two in learning Latin and Greek, not one in three could at the latter age read a Latin or Greek author with ease and intelligence. This may not in itself prove the case of science as an instrument of education, or even prove the inefficiency of classics; but at least it shows that classics have failed as a fact, and reduces us to this dilemma, that we must admit either that they are but a very imperfect means of education, or that the general standard of educability among young Englishmen is unaccountably low. One other alternative indeed remains, viz. the supposition that classics have been generally very badly taught, but this seems to us hardly tenable. It is difficult to believe that so much labour has been bestowed by so many good scholars as may be found amongst the schoolmasters of the last fifty years, upon the art of teaching classics, without the elements even of the art being discovered. At any rate reformers, or even revolutionists, in education may fairly argue, that what has not been done in so many years by a method which has had the whole field of the higher education to itself, is hardly likely to be effected by a persistent continuance in the same path. We are reminded of the physician of Laputa, of whom, when he had already almost killed his victim by his discipline, Gulliver says, "We left the doctor endeavouring to recover his patient *by the same operation*."

We have left ourselves no space in which to notice the remaining and more directly scientific portion of Professor Huxley's work. The book is not to be discussed fairly in the space at our disposal: it is, however, full of interest throughout, and we need perhaps the less regret that we are unable to direct our readers' attention to the remaining essays, inasmuch as they constitute that part of the work which deals with the scientific controversies of the day some of which have already been discussed in NATURE.

G. W. C.

FERNET'S ELEMENTARY PHYSICS

Traité de Physique Elémentaire. Par Ch. Drion et E. Fernet. Troisième Edition. (Paris: V. Masson et Fils. 1869.)

THE third edition of this well-known handbook of French physics deserves more than a casual notice. We are told in the preface that it has been entirely recast by the second of the two original authors, M. Fernet, a pupil of the lamented Verdet, who has caught something of the spirit of his master. There has been no teacher of physics in our time whose work has been, on the whole, comparable to that of Verdet. He has all the clearness of Tyndall; and, as almost all of his published lectures were delivered to audiences more strictly scientific than those to whom the famous books on Sound and Heat were originally presented, he is never diffuse. His arrangement of the essential points of his subject, and his grouping of the illustrative details and of the exceptions to the general principles which govern it, have scarcely been equalled even in France, which is the special country of precise and exhaustive exposition. It is high praise, therefore, to say of M. Fernet, that in parts his book recalls his master's method and style.

The treatment of mechanics which is common in this country places statics before dynamics. There is only one thing to be said in favour of this arrangement—that the idea which lies at the root of dynamics, that of change of rate of motion, is a little difficult for a beginner to

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catch, and it is very hard to get him to see how to express it in any but the simplest case. On the other hand, we have no clear notion of Force at all until we master it, and statics without that idea is a series of barren propositions, which stand to real life much in the same relation as a "uniform, weightless, perfectly rigid, straight rod" does to a real bar. M. Fernet accordingly places this conception at the commencement of his book, and we find the laws of uniformly accelerated motion given before the discussion of levers and centres of gravity.

It is extremely easy, and perhaps a little ungracious, to select for notice points the omission of which causes surprise even in an elementary work of 800 pages. The need of compression, which constrains an author who has to treat in one volume mechanics, hydrostatics, pneumatics, light, heat, sound, electricity, magnetism, and meteorology, is so great, that it is impossible to question too loudly the prudence of obvious omissions. But we should have expected to find a little discussion of the adhesion of liquid plates to the solids which they wet, and to each other, ; and one would willingly excuse the absence of the regulation picture of the balloon and its car, with the accompanying history of the brothers Montgolfier, for an account of the mercurial air-pump of Sprengel or Jolly. M. Fernet is perhaps a little open to the charge which is constantly brought against the scientific men of his country, that if they read anything but the science of the *Comptes Rendus* and the *Annales de Chimie et de Physique*, they never indicate the fact by a line or an allusion. M. Verdet alone, of well-known French scientific writers of our time, knew German and English as well as French science, and showed that he knew it. We should scarcely have found any book of his on the subject of heat, without any reference—as far, at least, as I can find—to Joule's principle of the equivalence of mechanical effect and heat, of the "mechanical equivalent" by which the one may be converted into the other, or of the fraction of the heat which can be converted into work by a perfect heat engine.

So far as it goes, in fact, the book is extremely clear and satisfactory; but it gives one less impression of a complete working up of the subject to the latest date than we had expected to find in it. Take for instance the well-known series of experiments by which Kundt established the velocity of sound in tubes of different materials. They were explained by Tyndall in this country a couple of years since, and it is impossible to conceive any which make more visible to the student those vibrations of bodies which he is constantly required to admit in the course of his reading on acoustics. The omission of all mention of the famous "singing flames" is more defensible from a purely scientific point of view, as the experiments scarcely admit precise measurements, and can only be relied on to convince any one who needs convincing how many astonishing things there are within the range of the science.

M. Fernet has given a considerable number of notes, in which there is a precise mathematical treatment of the statements in the text. We should be glad to see the plan followed more frequently in elementary treatises. In a book, the introduction of simple mathematics in a note does not distract the attention of the reader who is frightened even by a simple equation, and it gives precision to statements which can scarcely be fixed without them, or without a long and extremely tedious paraphrase. We are more doubtful of the advantage of a practice common in France, and which has crept into some English books; the introduction into the text of *notes non exigées*. These are parts which the student who is preparing for a special examination may omit if he chooses. The text of a book of this kind ought, it seems to us, to be either one thing or another—to be composed with a perfectly definite object, and to be one and indivisible. As it is, it produces something of the impression that is given occasionally when a single picture is used to illustrate two different propositions. The lines which belong to the first get so mixed with those of the second, that the student can follow neither. A book too full of *notes non exigées* is apt to be too little systematic and scientific for the more advanced student for whose benefit these notes are inserted, and to be made too difficult for the simpler readers whose wants are mainly kept in view. WILLIAM JACK

OUR BOOKSHELF

Cryptogames Vasculaires du Brésil. Par Prof. A. L. Fée avec le concours de Monsieur le Dr. Glaziou. Pp. 268, 4to., 78 Plates. (Paris: Baillière.)

PROFESSOR FEE is by many years the oldest amongst living fern-authors. He has held for more than a quarter of a century the chair of botany at Strasburg, and has concentrated his attention principally upon ferns and the other allied higher orders of cryptogamic plants. He published a general treatise upon the classification of the order as long ago as 1844, and since then many consecutive years have never passed without producing some memoir upon the subject from his fertile pen. Having recently received a fine collection of ferns from Dr. Glaziou, the superintendent of the Botanic Gardens at Rio Janeiro, he has been stimulated to add one more memoir to the series, and that is the work now before us. All the series of his monographs, several of which are in folio, are illustrated beautifully and copiously, not only with full-sized figures of the plants, but also with careful magnified analytical details; and together they form by far the most extensive and excellent series of fern-plates which anyone upon the Continent has published. The present memoir is quite upon a par with its predecessors in this respect. It is in quarto, and contains seventy-eight quarto plates and a list of all the ferns and fern-allies known to the author as inhabiting Brazil, with a list of special stations, but with descriptions of novelties only. But there is one drawback to the value of Fée's works, and that is a very great one. Living at a distance from the great metropolitan herbaria, our author has apparently worked almost entirely upon his own private collections, and has continually failed to recognise well-known plants, and has made new species in great numbers out of the specimens which his correspondents have sent him, which no one else has been able to understand as such. In none of his works—we have no alternative but to say—has this tendency been carried to a greater excess than in the present one. For Brazil alone he describes and figures in the present memoir upwards of 180 new species, so called. These are not from tracts of country which the collectors whose gatherings have been already reported upon have not visited, or have left unexplored, but nearly all from the vicinity of the capital, and from the gatherings of Glaziou. Now the neighbourhood of Rio Janeiro is exceedingly rich in ferns; but there is, perhaps, no other part of Tropi-

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